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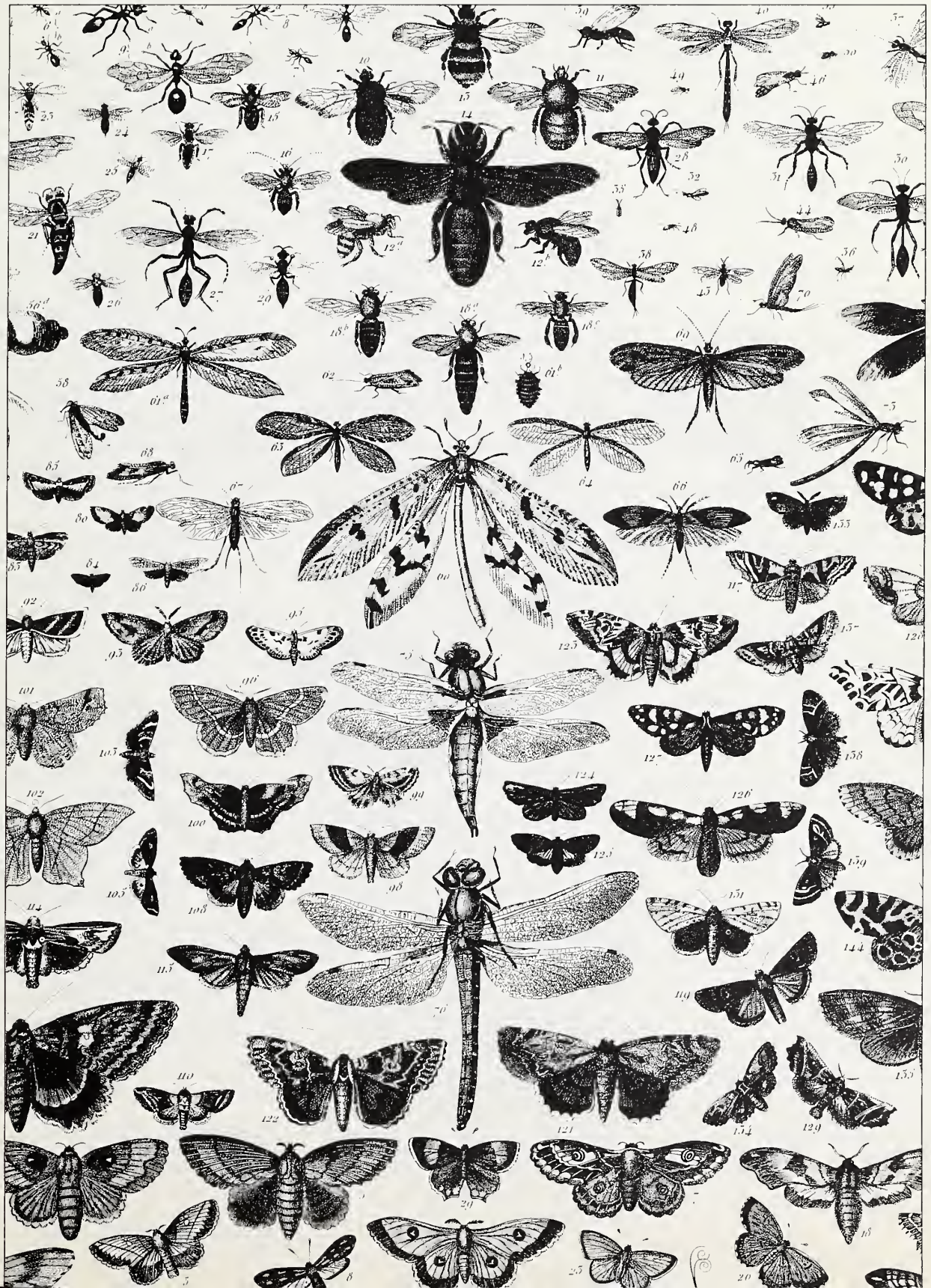

A Hungry, Quarreling, Uneasy World— The Driving Forces of Change*

Dr. Anson R. Bertrand
Director of Science and Education

Over these past 100 years, those who have gone before us, and many of us to this day, have assumed that our way of life can endure and evolve in much the same way as it has in the past. This assumption that what lies behind us can be extrapolated into the future has been the basis for most of our planning in agriculture as well as in other areas.

A rapidly growing opposite concept is that present trends are so different from the past and so destructive that we cannot avoid collapse of world society. This concept is disturbing to most of us in agriculture who are closely associated with a tangible, biological, and physical world that often changes slowly. But we cannot ignore these forces which are shaping the future and our way of life as well as other parts of society and government decisions.

All decisionmakers, including agricultural scientists, extension workers, and teachers, need a better sense of the broad range of alternative futures that lie ahead of us.

Last year, Secretary Bergland convened a conference on The Future of Renewable Natural Resources. He urged us to begin immediately to develop the data and analytical methods we need to improve our capability for long-range strategies. He is convinced that we must function in far more flexible ways if we are to deal with the uncertainties and extraordinary challenges of the next half century.

At that conference a number of "driving forces" were defined—many of them that are contributing and will continue to contribute to the hungry, quarreling, uneasy world Purdue University Dean of Agriculture R. L. Kohls described in his article, "When the Clouds Clear Away" published in the Purdue Agricultural Report, August 1979.

These driving forces promise to be intractable over the next two or three decades—forces to which we will most likely have to adapt rather than being able to completely control.

First is the matter of tensions between the **rich** and the **poor** countries. The gap between the rich and the poor of the world is a true source of insecurity and hostility—one that is going to be a continuing part of the international scene. It is a scene in which agriculture must operate. We cannot materially change the situation. Although generally good crops in the last 4 years have removed the aura of earlier crises, it is not possible to ignore the evidence that there are probably more hungry, malnourished people today than there were 5 years ago when the World Food Conference in Rome focused attention on the world's hungry.

Sol Linowitz, Chairman of the President's Commission on World Hunger, has underscored the need for a radical reordering of national and international priorities, with food concerns becoming a more integral part of the United States relations with the developing and developed world, including U.S. assistance, trade, investments, and foreign policy.

For many years the U.S. scientific and agricultural community has carried a heavy burden of research and development work for much of the rest of the world. Secretary Bergland has stated that we will continue to help meet short-term emergency food needs around the world. But he has also emphasized that poor countries must develop long-term national food strategies.

He believes that we should no longer feel obligated to shoulder the food and agriculture research and development burden for the entire world. Our European and Asian colleagues make major contributions, but some developed countries have not been carrying their fair share. President Carter recently launched a new initiative to encourage other nations to join with us in common research and development goals and to carry a larger share of this work.

(Continued on page 16)

* Parts excerpted from remarks by Dr. Bertrand commemorating the 100th anniversary of the Indiana Agricultural Experiment Station, November 1979.

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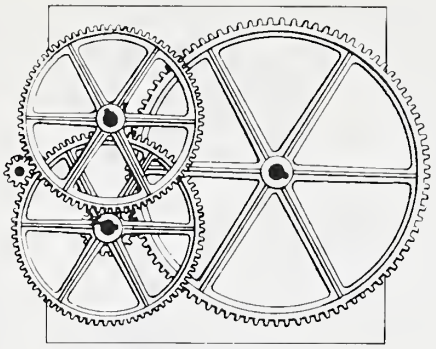
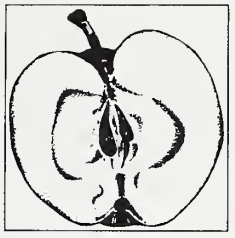
Anson R. Bertrand, Director of Science and Education

Talcott W. Edminster, Deputy Director for Agricultural Research

Cover: Controlling Mexican bean beetles and improving sand fly repellents are two of the many SEA insect-related research projects in the United States. Our articles begin on page 8.





Beef Hot-Processing Cuts Costs

Cross inserts electrical probe in carcass hindquarter for shock stimulation. The carcass will receive a constant 1½ amps current for 2 to 3 minutes (1079X1397-8).

Consumers can have higher quality beef and meat packers can save money if packers use a new method for handling beef carcasses after slaughter. This new method saves energy and labor, producing meat more tender and juicy than that from traditionally handled beef carcasses.

Most meat packers chill beef carcasses for 16 to 24 hours before cutting the carcasses up. If the meat is removed while the carcass is still warm, the muscles shorten and become tough. Chilling prevents this.

Now, however, SEA food technologists have found that if a carcass is electrically stimulated for 2 to 3 minutes after slaughter, the beef can be removed while the carcass is still warm and the meat will be tender. During hot processing, as this method is called, the beef is removed from the carcass, boned, cut into wholesale cuts, and chilled.

H. Russell Cross and Brad W. Berry of SEA's Meat Science Research Laboratory, Beltsville, found that hamburgers prepared from hot-processed beef carcasses were juicier, more tender, and lost 7 percent less weight in cooking than hamburgers prepared from chilled carcasses. Meat from hot processed beef carcasses also supported less bacterial growth than meat from chilled carcasses.

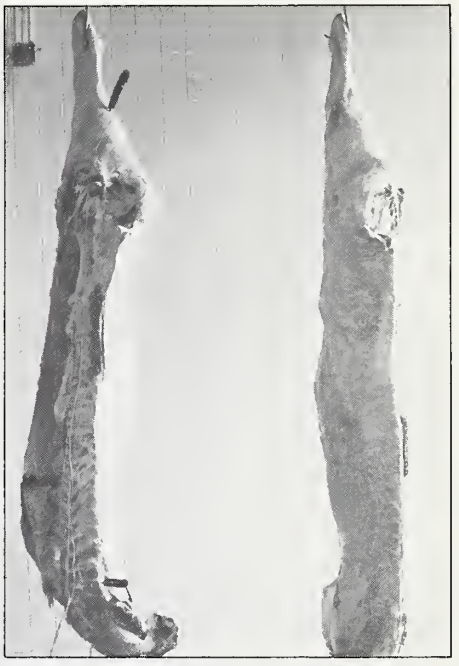
Steaks and roasts prepared from hot-processed-electrically stimulated carcasses lost less weight during marketing and were more tender than those same beef cuts prepared from chilled carcasses.

The scientists estimate that by electrically stimulating and then hot processing carcasses, packers can save 35 percent in chilling costs and 20 to 30 percent in labor costs over traditionally chilled and processed beef.

"The considerable savings in processing costs could be passed on to consumers if this method is adopted by the meat industry," says Cross. "Although some packers are hot-processing their beef, the reason most are not is because at present there is no way to grade hot-processed beef. The amount of marbling in beef, which is the basis for grading, is not as visible while the beef is still warm. We are now collecting data that can be used to develop grading standards for beef processed by this method."

"If industry went to hot-processing all their beef," says Cross, "consumers would find that traditional beef cuts look a bit different, because all hot-processed beef is boneless. Such cuts as bone-in sirloin and T-bone steaks would all be boneless. However, consumers would not be paying for the bones either. About 60 percent of all beef now on the market contains bones."

Dr. H. Russell Cross and Dr. Brad W. Berry are located at the SEA Meat Science Research Laboratory, B-201, BARC-East, Beltsville, MD 20705.—(By Mary Ellen Nicholas, SEA, Beltsville, Md.)



Upper left: Support scientist Ivonne Tennent and Cross pack hot-processed beef in a vacuum bag for chilling and marketing. All hot-processed beef is boneless: consumers will not have to pay bone weight (1079X1398-12).

Upper right: The lateral curling of the neck (lower left) shows the physical muscle contraction to electrical current. The carcass on the right has not yet been shocked. Electrical stimulation speeds rigor mortis development, allowing for immediate muscle removal without resulting tough meat (1079X1397-24).

Technician Ray Zephir removes strip steak portion of loin for chilling. Packinghouses can save energy and storage space by chilling carcass parts instead of the entire carcass(1079X1398-31).

New Spray System Cleans Carcasses

What's this? Showers for beef carcasses? No scrub brushes, no detergents necessary?

It's all true.

In tests at the Tarpoff Packing Company, Granite City, Ill., beef carcasses were spray washed to head off microbial growth that spoils and discolors meat, possibly reducing its value. The results point to better steaks and roasts that keep well on the meat counter.

Studies at the University of Missouri-Columbia show that 5 to 10 percent of the meat in the Nation's meat distribution system is downgraded because of microorganisms. Recognizing the problem, SEA scientists joined university scientists and the Tarpoff Packing Company to see what could be done.

SEA agricultural engineer Maynard E. Anderson, Columbia, and university colleagues designed the system that spray washes carcasses. It uses less water, energy, and labor than is normally used for carcass cleaning—and does it quicker.

The system is designed to alleviate contamination of meat that inevitably occurs during slaughter. Once the carcass is thoroughly cleaned, it is less prone to deterioration by microorganisms.

Researchers installed an 8-foot-long cleaning chamber with stainless steel spray bars and nozzles and three high-pressure pumps in the plant. The water flow rate, speed of the carcass conveyor, and the angle and force of spray were adjustable.

"We've found that each adjustment measurably affects the rate that foreign material is removed," SEA engineering technician Harold E. Huff said. "Through the studies we have taken the guesswork out of washing carcasses. With a given set of adjustments, the unit washes the same on Monday morning as on Friday afternoon."

Anderson says, "The unit is working fine." Evidently company officials feel the same, because they have invested capital improvements on a conveyor leading to the unit.

Craig Tarpoff, plant manager of the company, says, "We are happy to work with the researchers to develop methods for maintaining a high quality product for the consumer."

During the test phase, inspectors from USDA's Food Safety and Quality Service (FSQS) checked each carcass for cleanliness after it came through the experimental cleaning unit.

Anderson has applied for a public patent to be held by the Secretary of Agriculture so that other firms can make royalty-free use of the cleaning unit.

Dr. Maynard E. Anderson's address is Room 113, Eckles Hall, University of Missouri, Columbia, MO 65201.—(By Ben Hardin, SEA, Peoria, Ill.)

Ground Beef: Extra-Lean vs. Regular

Consumers may be wasting their money by buying extra-lean ground beef rather than regular ground beef, says SEA food technologist H. Russell Cross.

"Consumers may pay over 40 cents per pound more for extra-lean ground beef. But there is practically no difference in cooked hamburgers whether made from extra-lean or regular ground beef, except that hamburgers made from regular beef are juicier and a bit tastier," say Cross.

Cross reported earlier that weight loss during cooking is about the same for high- and low-fat hamburgers; and that in taste panel tests, patties made from ground beef with 12 percent fat did not rate as tender or as juicy as patties made from ground beef with 18 to 30 percent fat.

Now, he reports there is only a minute difference in the fat levels of cooked hamburgers whether made from extra-lean or regular ground beef.

Cross explains that although there is a difference in the levels of fat in the raw meat, regular ground beef loses more fat during cooking, while extra-lean ground beef loses more water. "The loss of fat is noticed because it accumulates in the pan," he says. "But water is lost as vapor and this weight loss is not as obvious."

Cross and his colleagues compared the weight losses, protein, fat, and water content of more than 200 ground beef patties in SEA's Meat Science Research Laboratory at the Beltsville Agricultural Research Center.

Patties weighed 3.5 ounces and ranged in raw fat content from 16 to 28 percent. Extra lean ground beef usually contains 15 to 18 percent fat, while regular ground beef has 23 to 26 percent fat. After cooking, the ground beef patties weighed about the same regardless of raw fat content.

For example, cooked, quarter-pound (114 grams) extra-lean patties had 1 gram (454 grams in a pound) less fat and 1 gram more water than regular ground beef patties. "This 1 gram of

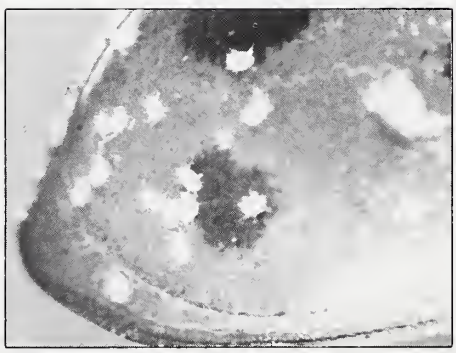
fat represents about 9 calories per patty," says Cross. The extra lean patties were also drier and tougher than those made from regular ground beef. The protein content was the same for all patties regardless of raw fat content.

"Consumers pay more for extra-lean beef for a variety of reasons," says Cross. "They may feel that leaner beef loses less weight during cooking, has fewer calories, or contains more protein. However, the hamburgers made from extra-lean beef have only 1 gram less fat, and 1 gram more water after cooking. Is it worth the extra cost?"

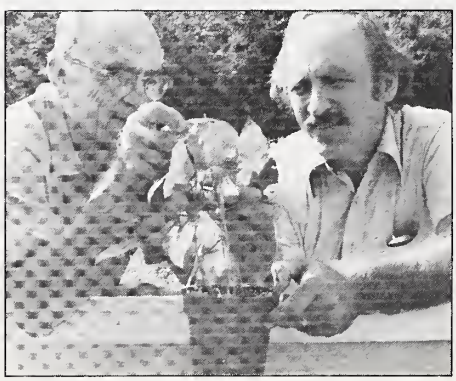
Dr. H. Russell Cross' address is Room 200, Bldg. 201, BARC-East, Beltsville, MD 20705.—(By Mary Ellen Nicholas, SEA, Beltsville, Md.)

Beetle Biocontrol — The Mating Game

Above: Mite eggs are deposited on the underside of the beetle's wing for protection against the elements. Roughly 1,250 eggs can be laid on each wing by 25 adult mites (1279X1719-9A).



Right: Immature mites feed on the underside of the beetle's wing. When the beetles mate, the tiny parasites transfer from one beetle to another where they mature and continue their life cycles (1279X1719-12A).



Lower right: Floyd Smith (left) and Robert Schroder breed hundreds of thousands of mites in field cages for distribution in soybean and small garden plots (0879X1170-3A).

Opposite: The mite's victim is the adult Mexican bean beetle, sucking its lifeblood and robbing the beetle of vitality—thus reducing its ability to reproduce (0879X1169-23).

Scientists are not at all worried about a sudden rise in a "social disease" among Mexican bean beetles in Beltsville, Maryland. In fact they encourage it.

Floyd Smith and Robert F. Schroder, entomologists with SEA's Beltsville Agricultural Research Center, imported the social disease for study from Central America. The disease is a pinpoint-size mite, a parasite that has an excellent chance to become an effective and cheap biological control agent against the bean beetle, according to Smith and Schroder.

The mites live beneath the wings of the beetles. They suck the blood of their hosts, robbing the beetle's vitality and reducing their ability to reproduce. The scientists call the mites a social disease because they crawl from beetle to beetle during mating.

Before you feel sorry for the beetles, consider that the Mexican bean beetle is the worst insect pest of bean crops in the U.S. Each year, farmers in Mid-Altantic states spend $5.25 an acre on insecticides to control the pest.

"The parasitic mite is, to my knowledge, the first one seriously considered for biocontrol of crop pests," says Schroder. "As a parasite of the adult or flying stage of the pest, the mite gives us a terrific dispersal system—the beetles themselves." By not having to develop a way to disperse the parasites, a time-consuming step in many biocontrol research projects, the scientists could have the mites ready for the farm in just 2 to 3 years.

The potential use of a mite in biocontrol has stirred considerable interest among other entomologists working on ways to control other insect pests, Schroder says.

The social disease story began in El Salvador several years ago. After Smith collected Mexican bean beetles for another project, his lab technician, Anthony L. Boswell, discovered that the beetles were heavily infested with mites. When the mites were found to be parasitic, Schroder returned to El Salvador and collected enough infested beetles to begin research. Quarantine studies showed that the mite does not

infest certain beneficial insects, including the ladybird beetle, a cousin of the Mexican been beetle.

At Beltsville, the mite has passed two critical tests. Smith and Schroder's experiments showed that the mites can overwinter in the Maryland climate on hibernating beetles, and that local beetles seem to pass the "disease" around with ease.

First, in autumn 1978, the scientists infested several hundred beetles with mites and placed them in hibernation cages. Up to 75 percent of the beetles still had mites in the spring.

Then, in summer 1979, the scientists placed 100 male beetles in some cages and 100 females in other cages. They then released into each cage 10 mite-infested beetles of the opposite sex. After 14 days, 70 to 95 percent of the "clean" beetles had become infested.

The Cooperative Extension Service of Maryland will help the Beltsville scientists conduct extensive field testing of the parasitic mites this summer. The mites will join an on-going program involving another bean beetle parasite—a tiny, nonstinging wasp that was imported by USDA from India in 1973. The wasp has helped reduce insecticide use against the beetles in many Eastern States.

The wasp, however, has a major drawback in that it cannot overwinter in the U.S. Each spring, state agricultural departments in Maryland, Delaware, New Jersey, and Virginia must redistribute the wasps. Farther south, the wasps will probably have to be released once every 2 to 3 years, the researchers say.

Smith and Schroder plan to release mites onto special nurse crops of lima bean plants that are used each year to distribute parasitic wasps. For distributing the wasps, scientists first raise a population of Mexican bean beetles on the nurse crops. Then they infest the population with wasps. Sometime in June or early July, the lima plants with beetles and parasites are distributed to soybean fields all over the state.

Smith says the two parasites appear to complement each other very well. The wasps attack beetle larvae, while the mites feed on adults and reduce the number of larvae they produce.

The parasites are part of a growing arsenal of weapons being developed by SEA laboratories for controlling bean beetles. SEA entomologists and plant breeders may soon release soybean varieties that are resistant to the beetles, as well as to other soybean pests. And, in a project just getting underway, scientists are looking at certain viruses that cause insect diseases, hoping to use the viruses against the beetles.

With science interfering with the health, diet, and sex life of the Mexican bean beetle, you would think the pest would decide to leave us our lima, snap, and soybeans, and go else where. SEA officials say that, at least, the new control weapons should be safer and cheaper than conventional controls, and that bean beetles will probably become less of a nuisance to farmers and gardeners.

Dr. Robert F. Schroder is with the SEA Beneficial Insect Introduction Laboratory, Room 7, Building 417, BARC-East, Beltsville, MD 20705. Dr. Floyd Smith is with the SEA Florist and Nursery Crops Laboratory, Building 470, BARC-East, Beltsville, MD 20705.—(By Stephen M. Berberich, SEA, Beltsville, Md.)

The Most Annoying Insect

Gallop hasn't taken a poll, but many entomologists—as well as sunbathers—think the biting midge is the most annoying insect that attacks humans.

SEA scientists are busy evaluating new and existing repellents which may be applied on human skin in an effort to protect the hapless victim.

The biting midge of the genus *Culicoides,* often called the sand fly, is found in a wide range of fresh and salt water environments, and is of concern to the U.S. Navy as well as civilians. Their interest lies in the prevalence of the midge around Naval installations such as Parris Island, S.C., and in the Caribbean and Panama.

Commonly referred to also as sand gnats, and sometimes sand fleas in the Southeastern United States and the Bahamas, these annoying insects may be called punkies, no-see-ums, gnats, or "teeth" in the Eastern U.S.

Biting midges easily pass through ordinary mosquito screening and netting. Repellents and insecticides are only partially effective, and studies have shown that both here and abroad, repellents show considerable variation in effectiveness between species.

Among the few options that appear promising for control are the use of repellent-treated net jackets and topically applied repellents.

In two series of field tests, five selected repellent compounds were evaluated in paired tests with a deet standard (a widely used repellent) against the biting midges *Culicoides hollensis* Melander and Brues at Parris Island, S.C., and *C. mississippiensis* Hoffman at Yankeetown, Fla.

The new repellents being tested were synthesized by J. P. McGovern at the Organic Chemicals Synthesis Laboratory, Beltsville Agricultural Research Center, Md. These test materials were selected from a group of repellents that showed good activity in earlier tests against stable flies, mosquitoes, and black flies. Formulations were made at Gainesville, Fla. The repellents were tested at both Parris Island, S.C., and Yankeetown, Fla., against natural field populations of biting midges.

The test methods were similar to those used for many years against mosquitoes which allow a determination of the degree and time of protection from actual bites where the insects are active. The research was partially funded by the U.S. Navy, Naval Facilities Engineering Command.

Repellency was determined in three ways: by biting rates on treatments vs. nontreatments, by length of time the treatment provided protection, and by calculating coefficient of protection.

"Compounds were paired directly against the deet standard in each test series," said entomologist Carl E. Schreck at USDA's Insects Affecting Man and Animals Research Laboratory, Gainesville. "Direct pairing is more indicative of differences between 2 compounds, in this study the difference between the standard deet and the candidate compounds."

With one exception, more bites were recorded on the deet treatment than on all other treatments at both sites and with both species. In all tests deet averaged 28 times greater protection against *C. mississippiensis* than the check while all other materials averaged 190 times greater protection. Similarly, against *C. hollensis,* deet averaged 61 times greater protection than the check while all others averaged 138 times greater protection.

The coefficient of protection calculations were of little value, says Schreck, because all gave relatively good protection.

Biting rates were most indicative in determining relative effectiveness.

Though all repellents tested were effective against both species, two compounds, A13-35765 and A13-35770, were found to be substantially more effective than the others as well as the deet standard.

"Even though deet was not as effective as the other compounds in these studies, it did give good protection in most of the tests. It should be considered an effective repellent against these species when it's used as a 25 percent formulation properly applied to exposed skin," said Schreck. "We think these new repellent compounds are promising. Now we need to see how widely effective they are against other biting midge species—particularly the closely related genus *phlebotomus,* a serious vector of the disease leishmaniosis in South America and North Africa."

Working with Schreck and McGovern were research technician Nelson Smith at the Insects Affecting Man and Animals Research Laboratory, P.O. Box 14565, Gainesville, FL 32604, and Lt. James McCormick and Chief Leonard Wilson of the Naval Preventative Medicine Department at Parris Island, S.C.—(By Peggy Goodin, SEA, New Orleans, La.)

Ozone Treated Tobacco Reduces Tar

SEA researchers have moved closer to reducing tar in tobacco by utilizing the very air cigarettes are said to pollute.

As many people know, it is the tar in cigarette smoke that is most dangerous. The tar contains polynuclear aromatic hydrocarbons (PAH), which may cause tumors. How, then, to reduce the amount of tar produced in the burning?

According to SEA chemist Abner I. Schepartz, Athens, previous laboratory work indicated that most of the PAH come from a small group of components in the tobacco leaf known as lipids—fatty acids and other waxy or fatty type materials. Scientists have developed a method to decompose these lipids in the leaf so that when burned, the quantity of PAH is greatly decreased.

The method consists of treating the tobacco with ozone (O_3), which is produced from oxygen (O_2) by an electrical discharge. The ozone causes PAH producing compounds to oxidize and decompose. "When the tobacco is subsequently burned, lower amounts of PAH are found," says Schepartz.

Ozonization of tobacco in an aqueous or methanol suspension produced decreases in solanesol content from 44 to 100 percent, in certain fatty acids from 45 to 93 percent, and in major sterols from 21 to 83 percent, depending on the tobacco and reaction conditions used.

These decreases, in turn, reduced the amount of the PAH fraction by 21 to 70 percent. Phenols and nicotine were also significantly reduced.

Can this be accomplished on a large scale?

"Ozone has found considerable application in the treatment of industrial and community water and wastewater. To our knowledge, it has not been applied to the treatment of tobacco. The tobacco could be ozonized in an aqueous medium, adaptable to industrial use. It should be possible to utilize the treated tobacco in the production of safer cigarettes and help us to reduce lung cancer," says Schepartz.

Shepartz warns, however, that these findings are based on laboratory tests and more research is yet to come.

Dr. Abner I. Shepartz collaborated with Dr. James J. Ellington and William S. Schlotzhauer, chemists at the SEA Tobacco and Health Laboratory, Russell Research Center, P.O. Box 5677, Athens, GA 30604.—(By Peggy Goodin, SEA, New Orleans, La.)

Calories Decrease— Diets Improve

Americans are eating diets lower in calories but of a generally better nutritional quality than they were in 1965. And Americans are eating out more frequently.

A panel of nutrition experts from SEA's Human Nutrition Center presented these conclusions during the USDA 1980 Outlook Conference held last November.

The panel used data from the Nationwide Food Consumption Survey, begun in spring 1977 but not yet fully analyzed, and the 1965 Household Food Consumption Survey. They compared food expenditures, amounts of food consumed, and nutrient content of diets of U.S. citizens over the 12-year span.

Frances J. Cronin, SEA home economist, summed up differences in the amounts of food eaten by households as reflected by changes in energy (calories) and nutrient levels. She also explained how information was obtained from 15,000 households in the 48 neighboring states for the 77-78 survey.

Information on household food use came from interviews with persons identified as being most responsible for food planning and preparation. Trained interviewers used an aided recall schedule to obtain the kind, form, quantity, and cost (if purchased) of each food and beverage eaten in the household during the 7 days prior to the interview.

Households were contacted at least 7 days before the interview and asked to keep informal notes to assist them in recalling the food eaten during the 7-day period. This procedure differed from that of previous surveys, when households were interviewed at the time of first contact.

Cronin also explained that she was reporting average quantities of food and nutrients from household food supplies in terms of an "equivalent person." This equivalent person is equal to 21 meals eaten at home in a week (based on 3 meals a day), and is used in an attempt to adjust for meals eaten away from home by household members and for meals and snacks eaten in the home.

Survey Comparison

A comparison of the two surveys showed changes in our population's age distribution during the last decade. Bureau of the Census statistics indicate a decline of about 6 percentage points in the percentage of the population (from 1965 to 1977) under 18 years. Those aged 18 to 44 years increased over 4 points and those over 64 increased 1 point.

The number of households with one or two members increased, while the number of households with five or more members declined.

Cronin noted that further analysis will be necessary to assess the impact of these changes, and pointed out that data being presented are average values, which mask household variations.

She said there was a 10 percent decline in food energy, probably due to decreased use (in 1977) of milk and dairy products, bread and cereals, fats and oils, and some sugar-based foods. However, there was not a decline in the levels of vitamins or iron, and only the level of calcium in food used decreased over the 12-year span. Cronin concluded that food had a higher nutrient density in 1977 than in 1965.

In general, households at different income levels in 1977 ate foods which were more similar in nutrient content than those in 1965. The increased consumption of meat, fish, and poultry by low-income households (in 1977) reflects an increased use of all types of meat, fish, and poultry, except bacon and salt pork. The low-income group also decreased their use of eggs and beans. Households in this group consumed more pork, poultry, fish, and luncheon meat, and less beef than did households in most higher income groups.

Households in the lowest income group increased use of vegetables between 1965 and 1977 to a level similar to or higher than those used by other income groups.

Households in the lowest income group also increased their use of fruits from 1965 to 1977, with most of the increase in citrus fruit and juices.

Average nutrient levels for households in the lowest income group surveyed generally improved more than those at other income levels. Both the nutrient levels and amounts of food used, at the various income levels in 1977, were more uniform than in data from the 1965 survey.

Food Dollars

SEA home economist Mary Y. Hama compared the way food dollars were spent and summed up several trends and patterns.

Money spent on food away from home increased from 17 percent in 1965 to 24 percent in 1977. Hama said households with relatively high incomes, both in 1965 and 1977, used more of their money for food away from home than did low-income households. But, the average money value of food used at home per person was only 20 percent higher for the highest income group than for the lowest income group.

Some changes in food consumption patterns appear to have taken place during the 12-year period, Hama said. Households spent more of their food dollar in 1977 to buy meat, poultry and fish; fruit; soft drinks, punches and prepared desserts. Less was spent on eggs, dry legumes and nuts; fats and oils; and the sugar, syrup, jelly and candy food groups.

Hama also noted that average quantities of foods used per person has also changed since 1965. In addition to those food groups that changed in food dollar values, alcoholic beverages underwent a marked change in quantity consumed. This may reflect the greater use of beer and wine, for which a larger volume intake has been typical, and to people's increased candidness in revealing their alcoholic consumption, Hama concluded.

Nutritive Content

Home economist Eleanor M. Pao compared average nutritive content of diet changes and related them to the 1974 Recommended Dietary Allowances (RDA).

Caloric intakes of all survey sex-age groups were lower in 1977 than in 1965—below the RDA by about 10 to 25 percent. The sharpest drop of all groups was infant intake of feed energy, protein, fat, and calcium. For most adult groups, calcium intakes were close to or above 1965 levels.

Pao noted that mean weights of people in most groups in 1977 were similar to mean weights for 1965. Thus, she said, the drop in caloric intake does not appear to be associated with weight loss. Perhaps a sedentary life style is more common in the 1970's than in the 1960's, Pao concluded.

The mean intake of protein for infants decreased from 39 grams in 1965 to about 25 grams in 1977. Pao said this sharp drop may reflect a change in composition of baby formulas from those made with evaporated cow's milk, as was common in the 1960's, to formulas developed to resemble human milk in the 1970's. Human milk has about one-third as much protein as cow's milk.

Infant iron intake in 1977 was more than twice that in 1965, but the average iron intake for 1- to 2-year-olds was much lower—about 45 percent below the 1974 RDA. Females aged 12 to 50 years had an average iron intake between 35 and 40 percent below the RDA, as was the case in 1965.

Diets of older men and women seem to have decreased least among the groups in energy, protein, and fat, Pao reported. Their average calcium, vitamin A and vitamin C intakes were higher. Pao noted that intakes of protein and fat declined for most sex-age groups in 1977.

Average nutrient intakes for protein, vitamin A, riboflavin, and vitamin C met the 1974 RDA for all sex-age groups in 1977. Vitamin C in diets increased greatly from 1965 to 1977.

Total Consumption

D. Mark Hegsted, administrator of the Human Nutrition Center, said total food consumption of Americans appears to be at a very low level. Yet, he commented, we are as big and fat as we ever were, so he feels obesity may be gaining on us as we become more sedentary in our lifestyles.

Commenting on the way food is being wasted, Hegsted said there appears to be great opportunities to conserve food in the same way there are opportunities to conserve energy—explaining that the two are not unrelated.

He said the survey comparison is encouraging as it indicates that former differences (spread) are coming closer together between the various income levels in dollars spent for food and the kinds of food used. He felt lower income groups had been assisted by food programs between 1965 and 1977, so they now share more fully in the country's abundant food supply.

At the same time, Hegsted said, 3 percent of all households report they do not have enough food, and this rises to 9 percent in low-income groups. Much remains to be done, especially in a country that may waste nearly half of the total food available.

Though we complain about food costs and other faults of the food system, Hegsted said, food costs for most Americans are low compared to the rest of the world. He didn't think most U.S. citizens would willingly trade what our agricultural and food systems have achieved compared with that available in other parts of the world.

Given the fact that the 1977 survey data came from 15,000 households, and also includes data on 34,000 individuals who consumed nearly 20,000 different products, Hegsted concluded that to produce any kind of report is a formidable task. He also noted that statistical data can be exploited for a variety of purposes, both legitimate and not, and urged everyone to use the food consumption survey data honestly and constructively.

The most recent survey is the sixth done by USDA since 1936. The data was compiled and studied by SEA employees in the Consumer and Food Economics Institute of the Human Nutrition Center.

When completed, the survey will provide detailed information on food used by households, from which the nutritional quality of household food supplies can be estimated. It will also provide data on home production of food, household income, participation in food programs, education and employment of household heads, and other factors affecting food consumption.

Dr. Frances Cronin, Dr. Eleanor M. Pao, and Mary Y. Hama are located in the Federal Building, Room 336, 6505 Belcrest Road, Hyattsville, MD 20782. (By Stu Sutherland, SEA, Washington, D.C.)

EDITOR'S NOTE: This article was compiled from four papers presented at the 1980 National Agricultural Outlook Conference. They are: "Nationwide Food Consumption Survey Implication" (Hegsted), "Nutrient Consumption Patterns of Individuals in 1977 and 1965" (Pao), "Changes in Household Food Consumption in the U.S., Spring 1977 and 1965" (Hama), and "Changes in Nutrient Levels and Food Used by Households in the U.S.", Spring 1977 and 1965 (Cronin). Copies of these papers are available on request by writing to Agricultural Research Magazine, Outlook Papers, Room 3139-South Building, USDA, Washington, D.C. 20250.

Cereal Sugar Content

Research on 62 ready-to-eat breakfast cereals, analyzed for the five main food sugars, reveals that 3 of the 62 cereals apparently have no added sugar, 2 contain more than 50 percent sugar, and sugar content of the other cereals runs the full range between these two levels, says research chemist Betty W. Li, of the SEA Human Nutrition Center.

Li said the amounts of total sugar she found are similar to amounts previously reported for some of the cereals. "The main difference between our analyses and those previously done is that we analyzed for all the main food sugars. These are sucrose, fructose, glucose, lactose, and maltose.

"In the past, analysis of foods for individual sugars was not routinely done because earlier methods were not able to separate all possible combinations of sugars in a mixture. With such data available now, we hope more studies on nutritional differences of sugars will be conducted."

Li and chemist Priscilla J. Schuhmann, both in the Nutrient Composition Laboratory at the SEA Beltsville Agricultural Research Center in Maryland conducted the research.

One responsibility of the laboratory is to provide nutrient data that are needed but not available from other sources. Amounts of individual sugars in foods is an example of such data.

Cereals analyzed by Li and Schuhmann were purchased at retail stores in the Beltsville area. Three lots of each cereal were analyzed—a "lot" was a separate cereal box. The three boxes of a product were either purchased from separate retail outlets or had different expiration dates. The scientists estimate that the 62 cereals analyzed account for about 90 percent of the cereals purchased by the American consumer.

As expected, the analysis showed that cereal manufacturers add far more sucrose (table sugar) than any other sugar. Presence of lactose indicated that milk, milk chocolate, or milk powder was added during processing, and presence of maltose indicated addition of corn syrup. Fructose and glucose occur naturally in raisins, and products containing raisins had these sugars at considerably higher levels than products without raisins.

If fructose and glucose were present in about the same amount and at very low levels they probably derived from sucrose, which is a "double sugar," or disaccharide, containing one molecule each of fructose and glucose. During processing some sucrose may break down to its "single sugar" components. Three cereals had no detectable sugars except levels of sucrose that occur naturally in grain, and it is assumed that no sugar was added to these products during processing.

Concerning the health or nutritional significance of the data, Li explains that the responsibility of the Nutrient Composition Laboratory in this study was to provide data on nutrient content, and interpretation of the data for health and nutritional significance is the responsibility of medical and nutritional specialists.

She also points out that presentation of the data does not constitute endorsement of any product by USDA, nor is any discrimination intended with regard to products not tested. Also, these data were only for those samples analyzed and there was no warranty implicit or implied that other lots of these cereals would contain the same amount of sugar.

Copies of the data from Li's cereal sugar content analysis are available on request from the SEA Northeastern Regional Information Office, Bldg. 003, Rm. 250, USDA, Beltsville, MD 20705.

Dr. Betty Li's address is Room 318, Bldg. 308, BARC-East, Beltsville, MD 20705.—(By Andy Feeney, SEA, Beltsville, Md.)

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A **second** driving force is that of **demographics.** Few people today even begin to appreciate the significance of changes that lie in store for us because of changes in the age mix of our population and in overall population growth rates.

We know these changes in our population mean changes in the numbers and kinds and whereabouts of our voters and taxpayers . . . our workforce . . . our elderly . . . our young people—and that all of these and more will influence agriculture. But we do not know **how** it will be influenced.

We need to team demographers, sociologists, psychologists, and others to conduct research to develop answers required for intelligent planning.

A **third** force to be reckoned with is migration. In the past, migrations from east to west, south to north, and rural to urban have influenced us greatly. Now the trends are north to south and urban to rural. How long will these trends endure, and what do they portend? While the number of small, part-time farmers is increasing, the size of commercial farms is growing, and we need to know the significance of this to the structure of American agriculture. Our research and education programs must be directed toward these changes, too.

Ecological **concerns** are a **fourth** driving force. The great awakening of ecological consciousness in the past two decades is beginning to be matched with a realization of the true cost of cleaning up the environment—as well as the cost of not cleaning it up.

We must recognize that we have environmental problems caused by the way agriculture has functioned in the past. We have used pesticides and other chemicals to excess in some places; we have adversely affected the health of our neighbors by careless application methods; we have permitted excess erosion into our many streams and lakes—all of this while we were in the process of developing the most wholesome and abundant food supply in the world.

Agriculture needs time to make adjustments to a less polluting mode of operation—time to make adjustments based on research findings that take account of all the consequences and changes, including economic and social impacts.

Farmers are basically environmentalists. They do not want to degrade the environment for themselves or their neighbors. But their acceptance of alternative methods of production and resource management will in a larger measure depend on whether they find these methods economically and operationally acceptable.

A **fifth** driving force—and certainly one of the most intractable—is that of **energy** and other **resources.**

Our agriculture's vaunted productivity, as we all know, has been based in the past several decades on increasing amounts of external inputs of chemicals, machinery, fossil fuels, and research results. Future energy costs will be higher in terms both of money and environmental degradation. This will force significant changes in agriculture—changes which we must try to anticipate and cope with.

Climate is still another driving force that will require rethinking of our present policies and priorities.

We have enjoyed an unusually long period of favorable weather in this country—certainly a major contributor to our agricultural productivity—but we know that we cannot expect that to continue indefinitely.

These then are some of the major forces that will be shaping our future, at least to the end of this century, with which we must be prepared to deal.

NEXT MONTH: The kinds of agricultural research needed to meet the challenges of these forces as we enter the 1980's.